Using Kano and TRIZ to Investigate the Mobile Dining Car Service Quality in Taiwan

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Abstract: This purpose of the research presented in this article is to comparing different service quality measurements between Kano and TRIZ that plays the critical roles in the catering industrial. Data collected from a DINESERV questionnaire comprises service-quality standards to increase customer satisfaction of mobile dining car. Finally, the TRIZ is standardized measure designed to improve the idealization of strategy for selecting the most appropriate service quality model. In addition, the preferences of more than one decision maker are internally aggregated into the TOPSIS procedure. The findings of this study provide several important theoretical and practical implications for developing a successful mobile catering app. The results have demonstrated our approach to be both robust and efficient.

Keywords: service quality; Kano; TRIZ; catering industrial; mobile catering car; TOPSIS

1. Introduction

In the early 21st century, service industries accounted for more than three-fifths of the global GDP and employed more than one-third of the labour force worldwide. According to research report, on "Retail and Food Services" published in 2019 by Ministry of Economic Affairs, agriculture, industry, and service sector accounted for about 1.62%, 30.7%, and 67.6% respectively in Taiwan's GDP. The causes of the global financial crisis were, ostensibly, this shifts the employment from manufacturing to the service sector. With the development of catering business and spread of business chains, the company will develop competition advantage of a business model in differentiated-catering-product markets. A mobile diner business is a great way to expand existing restaurant sales or break into the catering industry. A diner is a small restaurant found predominantly in USA. Diners attract a wide spectrum of the customers, and are generally small businesses. The lower entry costs of a mobile diner make them a popular starting point for new business owners. A mobile setup is a smart way to try out different locations, and build a loyal following before taking the plunge for real. The mobile diner settled around a

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unique menu, which managed to meet the economic requirement of volume sales and expectation for rapid food service. In light of these concerns, a mobile diner doesn't just boost customer satisfaction and make your business more profitable. In order to investigate the expectations placed on different attributes in relation to the overall satisfactions of mobile diner with context-aware information adapted to their personal requirements. Bae et al. [1] developed a web-based system for analyzing the voices of call center customers of a life insurance company; so that it would help decision makes understand customer needs better. Hongzhen et al. [2] presented an integration of wireless communication, wired communication and web services technologies to implement a nutrition catering system of hospitals through both desktop PCs and mobile devices. Wang et al. [3] developed and validated a mobile catering app success model based on the e-commerce system success model.

2. Research purpose

In view of the preceding literature, the TOPSIS and TRIZ were used to obtain the priority of the important service quality attributes to be improved. Therefore, the main purposes of this study were to integrate the Kano model with TRIZ to improve the service quality of mobile devices, to develop the priority of quality attributes and to propose location selection meeting the needs of users.

3. Literature review

3.1 Mobile *diner*

A diner is a small restaurant found predominantly from 1920s to the 1940s in USA. Over 80 percent of North Americans regularly eat in the car, yet neither mobility literature nor expanding discussions of food cultures focus on the practice. Diners offer a wide range of foods, mostly American cuisine, a casual atmosphere, and, characteristically, a combination of booths served by a wait staff and a long sit-down counter with direct service. Diners typically serve staples of American cuisine such as hamburgers, french fries, club sandwiches, and other simple, quickly cooked, and inexpensive fare, such as meatloaf. Hongzgen et al. [2] presented an integration of wireless communication and web services technologies to implement a nutrition catering system of hospitals. Xu and Huang [4] provided important implications for restaurant industry to design marketing messages more effectively via foodservices apps. Lucan et al. [5] developed a method to assess mobile food vendors from existing food-environment research. Botterill [6] presented the multi-perspectival cultural approach to eating in the car. According to the Ministry of Economic Affairs (MOEA), the economic output of Taiwan's food service sector, was estimated at 12.9661 (million) in 2019. Results of the statistics are presented in Figure 1 shows that the food service sector has had stable growth over the past decade with tourism development cited as the primary driver. Other factors such as the rise in consumer income, smaller, family size, a growing number of working women and the growth of e-commerce have helped the food service sector grow. Food is one of Taiwan's top strengths as a tourist destination, whether the tourists opt for night market snacks, mobile dinner car or fine dining.
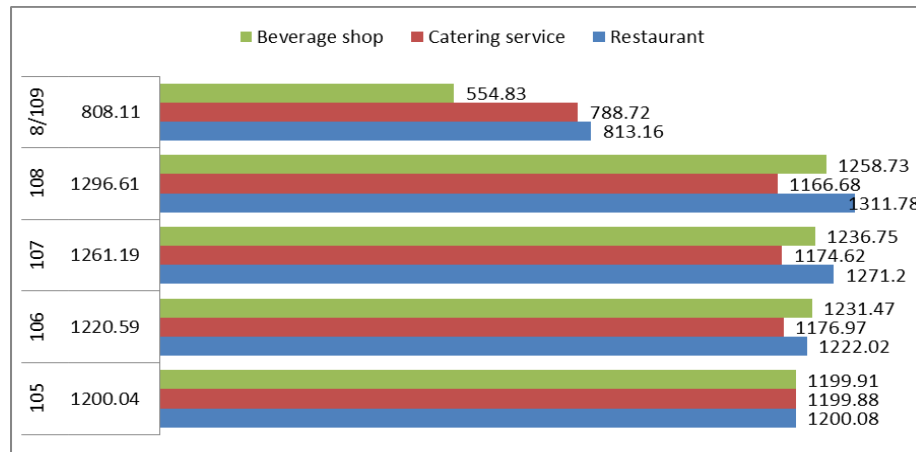
Figure 1. Taiwan food service revenues. Source: Ministry of Economic Affairs (MOEA)

3.2 Service Quality

Several studies have pointed out that a business with high quality will increase its customer satisfaction while retaining customer loyalty. e.g., Horowitz [7], Ferguson and Zawacki [8]. Services play an important role as regards GDP and employment in the OECD countries, we still know very little about quality management in service operations. Edvardsson [9] provide extensive discussions of the concepts and models of organization theories, marketing and other field are, to a great extent, based on studies of and experience from manufacturing companies. Qin and Prybutok [10] explored the potential dimensions of service quality, and examine the relationship among service quality, food quality, perceived value, customer satisfaction and behavioral intentions in fast-food restaurants (FFRs). Tzeng and Chang [11] identified both the importance and performance of restaurant service quality in the Taiwan food service industry using the SERVQUAL and IPA model. Tucci and Talaga [12] used consumers' measures of the relative importance of these attributes it is found that consumers do show a differential ranking of the different attributes of restaurants. Lee et al. [13] investigated the relative importance of tangible service attributes toward diners' satisfaction within the upscale dining segment. Dwaikat et al. [14] explored the impact of customer satisfaction on behavioral intensions in pizza restaurants. With the service industry booming across the world in the 21st century, Taiwan has been transformed from a manufacturing economy to a service-oriented one. Parasuraman et al. [15] made further evaluations and improvements to SERVQUAL to have it apply to different types of service industries. The instrument has been applied across a variety of service settings, fast restaurants (Lee and Ulgado [16]), lodging services (Getty and Thompson [17]), restaurant services (Bojanic and Rosen [18]), and medical services (Brown and Swarz [19]). The SERVQUAL advocated by Stevens et al. [20] is a growing popular measuring instrument for assessing the quality of a service quality of a restaurant. However, there is very limited study on the service quality of mobile diner in the literature. Li et al. [21] developed an E-commerce on-line catering reserving and ordering system based on mobile platform. Shah et al. [22] examined the effect of mobile apps, food quality, and service quality on customers' perceived value depend on the different levels of restaurants. Zhong and Moon [23] investigated the factors that can influence customer satisfaction, loyalty, and happiness, with a particular focus on the moderating role of gender.

3.3 Kano *model*

Early theorization of Kano model can be traced back to Herzberg-Frederick et al. [24]. The papers in Berger et al. [26] provide extensive discussions of the strategic important of customer satisfaction, Kano's model with quality function. Schvaneveldt et al. [27] has proposed a two-part of perspectives by which consumers evaluate quality in the mass-market services, such as retail banking, cleaners, family restaurants, and supermarkets. Matzler and Hinterhuber [28] proposed a discussion of customer satisfaction based on Kano's model, using a case study from the ski industry. The results of the individual

product criteria are listed in the table of results (Table 1) which shows the overall distribution of the requirement categories. Based on the responses to the two parts of the question in Figure 2, the customer requirement (how good gas mileage is, in the example) can be classified into one of six categories: A=Attractive; M=Must-be; O=One-dimensional; I=Indifferent; R=Reversal; Q=Questionable. Djekic et al. [29] determined oral processing parameters with mechanical properties of selected confectionery products and categorize oral processing based on a Kano model.

3.4 TRIZ

TRIZ approaches are widely used in service design tools and idea generation practices, which offers a systematic problem-solving methodology. TRIZ approaches can be traced back to Altshuller (1946). TRIZ places 39 parameters, identified through patent analysis, into a matrix in which technical contradictions can be detected. It also outlines 40 principles of creative invention to resolve the contradictions, and solutions are achieved by matching the contradiction with its appropriate principle. In a recent article in TRIZ Evolution Trends (TETs), Barragan-Ferrer et al. [25], investigated the improvement of the innovation process via TRIZ Evolution Trends, the technology push and the market pull strategies.

By combining the five answers in the following evaluation Table 2, the product features can be classified. Configuration index, which provides a decision factor for selecting the functional requirement (FRs) that contribute to product configurations. On the other hand, Kano evaluator, which is shared surplus-based performance indicator leveraging upon both the customer's satisfaction and the producer's capacity. A comprehensive process model is proposed to integrate these techniques for customer need analysis.

Table 2. Kano evaluation table.

Customer Requirements		Dysfunctional form of the question				
		I. like	II. must-be	III. neutral	IV. live with	V. dislike
Functional form of the question	Like	Q	A	A	A	O
	II. must-be	R	I	I	I	M
	III. neutral	R	I	I	I	M
	IV. live with	R	I	I	I	M
	V. dislike	R	R	R	R	Q

A: Attractive; O: One-dimensional; M: Must-be; Q: Questionable result; R: Reverse; I: Indiff

3.5 Kano's model of customer satisfaction

Kano [30] distinguishes between three types of product requirements which influence customer satisfaction in different ways when met.

Must-be requirements: The must-be requirements are basic criteria of a product. Fulfilling the must-be requirements will only lead to state of "not dissatisfied". The customer regards the must-be requirements as prerequisites, he takes them for granted and therefore does not explicitly demand them. Must-be requirements are in any case a decision competitive factor, and if they are not fulfilled, the customer will not interested in the product at all.

One-Dimensional requirements: With regard to these requirements, customer satisfaction is proportional to the level of fulfilment-the higher the level of fulfilment, the higher the customer's satisfaction, and vice versa. One-dimensional requirements are usually explicitly demanded by the customer.

Attractive *requirements:* Fulfilling these requirements leads to more than proportional satisfaction. If they are not met, however, there is no feeling of dissatisfaction. Kano's model of customer satisfaction is depicted in Figure 2.
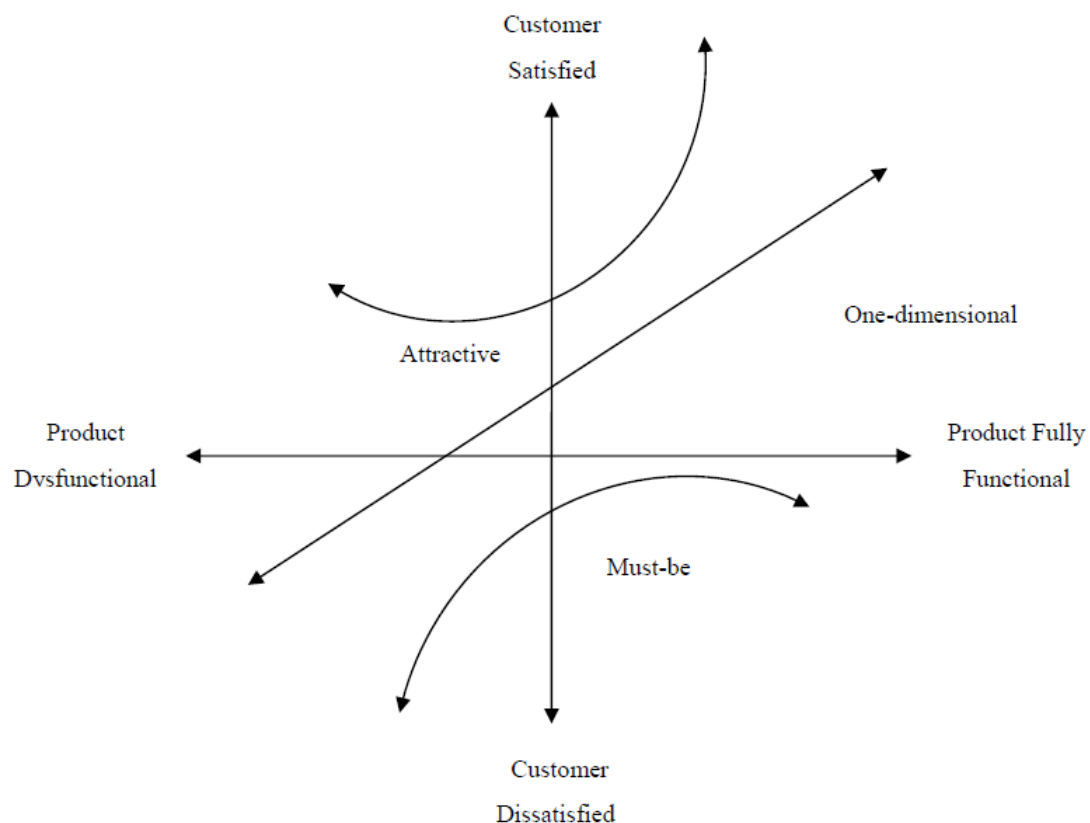

Figure 2. Kano's model of customer satisfaction.

3.6 Conceptual framework

Based on the principles of TRIZ, we propose a new approach to systematic service design that comprises four main stages. The input to the method is an identified service problem. At Stage 1, the identified problem is "translated" into the language of TRIZ to provide insightful information for further problem solving. At Stage 2, the problem is structured into typical TRIZ contradictions by conducting contradiction analysis, one of the most effective problem resolution tools. TRIZ knowledge-based principles such as 40 inventive principles and 4 separation principles may then be employed to eliminate the contradictions. At Stage 3, the generated ideas are evaluated by using the unique TRIZ criteria, which

is the ideal final result. The final output is a list of possible innovative conceptual solutions to service design. We can represent the above TRIZ framework with the flow chart shown as Figure 3.
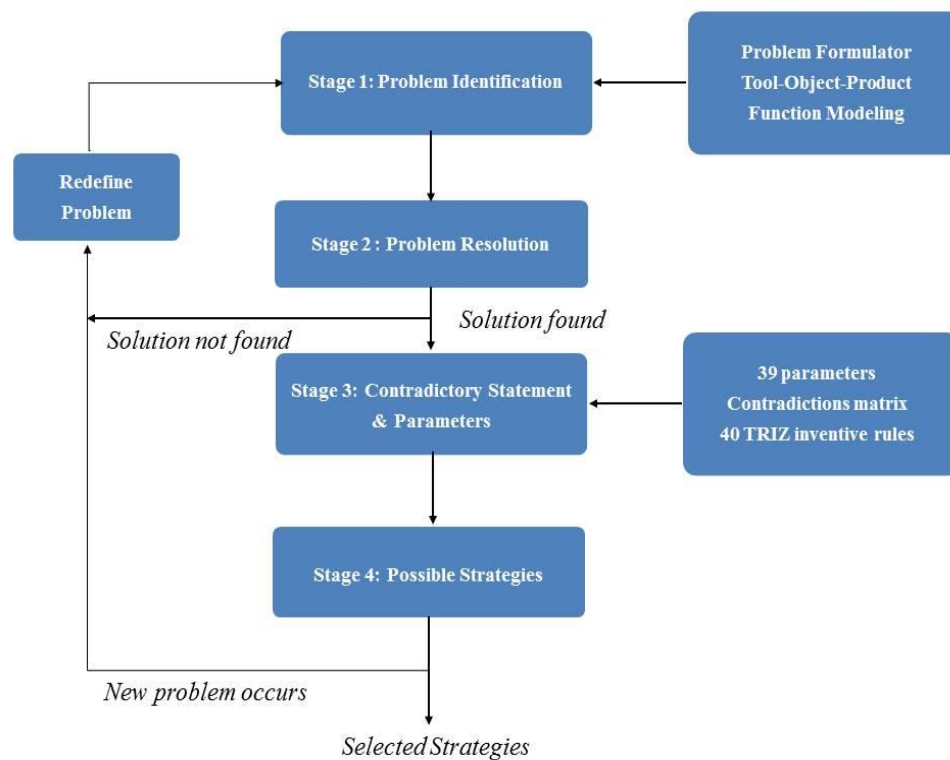

Figure 3. Modified TRIZ framework solving process in service design.

4. Research framework and implementation

4.1 Theoretical framework

Based on the principles of TRIZ, we adapted DINESERV, introduced by Stevens et al. in 1995 as a way of determine how customers perceive the quality of service in a mobile diner. Kano model has been used to reflect the needs of customers in mobile diner, while TOPSIS was developed to evaluate service quality of mobile diner. Then we studied consumer expectations about mobile diner and found that the four dimensions had the same ranking in all segments. Listed in descending order of importance to lodging consumers, the other dimensions are reliability, responsiveness, assurance, and empathy. The framework of catering services (Stevens et al., [20]) offers an opportunity to measure the ways in which dining consumers determine which restaurants meet their quality and value standards. The 29-item DINESERV questionnaire comprises service-quality standards that fall into five categories: assurance, empathy, reliability, responsiveness, and tangibles. A picture of the research framework is depicted in Figure 4.
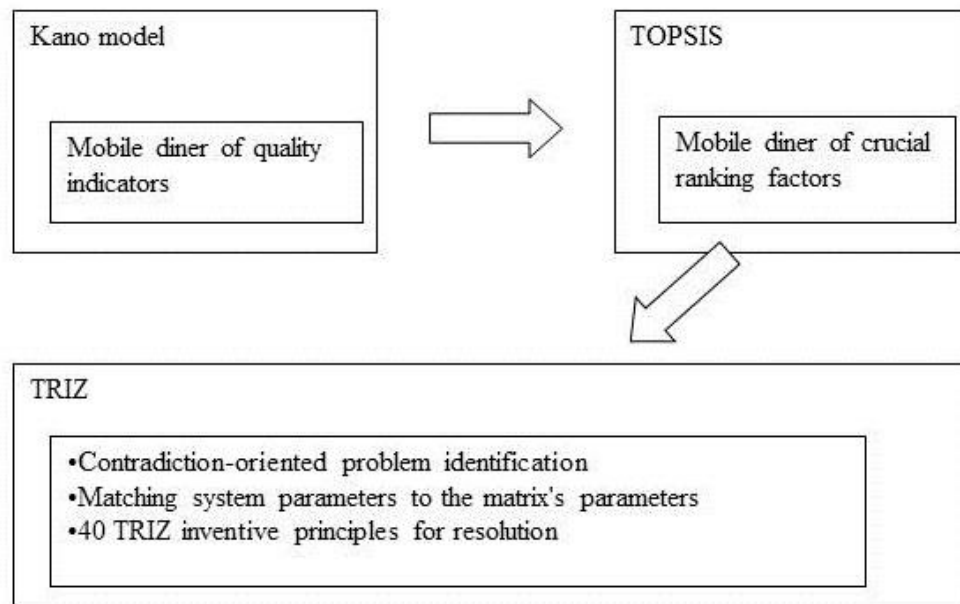
Figure 4. Research framework.

4.2 Participants

Utilizing Stevens's [20] Food-Service Operations as the theoretical framework, this study employed a questionnaire to sample the views of 500 end-user customers. Participants were 42.2% male and 57.8% female. They came from various regions of Taichung. The subject was asked to fill out a questionnaire which elicited information concerning his attitude and motivation. 51.1% of participants were at the income group of less than 18,780 TWD. 20.0% of participants were at the income group of 18,781-22,800 TWD. 17.8% of participants were at the income group of 22,801-28,800 TWD. 11.1% of participants were at the income group of 28,801-36,300 TWD. Further, 15% of participants were at the location group of park. 25.5% of participants were at the location group of shopping area. 9% of participants were at the location group of traditional markets. 20% of participants were at the location group of night market. 32% of participants were at the location group of tourist attraction.

4.3 Customer satisfaction coefficient

The CS-coefficient is indicative of how strongly a product feature may influence satisfaction or, in case of its "non-fulfillment" customer dissatisfaction. To calculate the average impact on satisfaction it is necessary to add the attractive and one-dimensional columns and divide by the total number of attractive, one-dimension, must-be and indifferent responses.

Extent of satisfaction (ES)

$$\frac{A+O}{A+O+M+I} \tag{1}$$

Extent of dissatisfaction (ED)

$$\frac{O+M}{(A+O+M+I)*(-1)} \tag{2}$$

Table 3. show that the CS analysis is compared between Extent of satisfaction (ES) and Extent of dissatisfaction (ED).

Table 3. CS coefficient.

Items	ES	Rank	Items	ED	Rank
28.Maximizing customer wealth	0.747	1	13. Increasing customer loyalty	-0.7882	1
8. Cleaning restrooms regularly	0.739	2	12. Providing fast and easy ways to correct errors	-0.7152	2
2. Providing an attractive environment for dining	0.726	3	15. Providing good quality menu	-0.7030	3
7. Getting comfortable with a more physical activity	0.711	4	22.Creating feeling of security	-0.6660	4
9. Keeping the environment clean	0.705	5	27. Showing empathy in customer service	-0.6456	5
10. Providing a comfortable seat	0.703	6	28.Maximizing customer wealth	-0.6390	6
18. Meeting Special Needs	0.700	7	19. Providing problem-solving skills	-0.6380	7
26. Achieving customer satisfaction	0.685	8	20. Keeping your client at ease	-0.6336	8
25.Offering product customization	0.682	9	14keeping good accounting records	-0.6332	9
27 Showing empathy in customer service	0.6806	10	9 Keeping the environment clean	-0.6150	10
6 Creating an attractive arrangement of your menu items with restaurant branding	0.6790	11	17 Providing fast service assistance	-0.6006	11
17 Providing fast service assistance	0.6626	12	5 Offering more clarity on menu labeling	-0.5720	12
1 Attractive appearance clean parking lot available	0.6603	13	25 Offering product customization	-0.5630	13
4 Building brand image and modern decoration	0.6433	14	23 Creating an effective training program	-0.5501	14
3 Owning Well-dressed employees	0.6396	15	2 Providing an attractive environment for dining	-0.5340	15

Table 3. CS coefficient (Continuous).

Items	ES	Rank	Items	ED	Rank
21 Offering menu information	0.6285	16	26 Achieving customer satisfaction	-0.5305	16
5 Offering more clarity on menu labeling	0.6050	17	7 Getting comfortable with a more physical activity	-0.5275	17
23 Creating an effective training program	0.6042	18	16 Providing mutual support	-0.5525	18
13 Increasing customer loyalty	0.6024	19	1 Attractive appearance clean parking lot available	-0.4769	19
20 Keeping your client at ease	0.6006	20	11 Providing on-time service	-0.4654	20
22Creating feeling of security	0.5750	21	8 Cleaning restrooms regularly	-0.4582	21
19 Providing problem-solving skills	0.5530	22	18 Meeting Special Needs	-0.4514	22
12 Providing fast and easy ways to correct errors	0.5434	23	6 Creating an attractive arrangement of your menu items with restaurant branding	-0.4483	23
11 Providing on-time service	0.5425	24	21 Offering menu information	-0.4257	24
16 Providing mutual support	0.5225	25	4 Building brand image and modern decoration	-0.4145	25
24 Providing enough resource availability	0.5155	26	3 Owning Well-dressed employees	-0.4044	26
15 Providing good quality menu	0.5100	27	10 Providing a comfortable seat	-0.3847	27
14 keeping good accounting Records	0.4609	28	24 Providing enough resource availability	-0.3773	28

4.3 Comparison with Kano and TOPSIS

Next, the Kano method is compared with TOPSIS method, with Table 4 listing the results of the comparison. However, TOPSIS suffers some disadvantages in terms of its calculation methods and results in uncertain environment. However, based on the results, the method of TOPSIS (see S* values) does not discriminate clearly among service quality.

Table 4. Comparative analysis with Kano and TOPSIS in the catering field.

Items of Service Quality Measurement		KANO		TOPSIS		
		Extent of satisfaction	Extent of dissatisfaction	S*	S-	Cí
01	Attractive appearance clean parking lot available	0.6603	-0.4769	0.0424	0.1207	0.7401
02	Providing an attractive environment for dining	0.7264	-0.5340	0.0532	0.1167	0.6867

03	Owning Well-dressed employees	0.6396	-0.4044	0.0333	0.1401	0.8081
04	Building brand image and modern decoration	0.6433	-0.4145	0.0333	0.1373	0.8047
05	Offering more clarity on menu labeling	0.6050	-0.5720	0.0781	0.0847	0.5201
06	Creating an attractive arrangement of your menu items with restaurant branding	0.6790	-0.4483	0.0314	0.1319	0.8078
07	Getting comfortable with a more physical activity	0.7111	-0.5275	0.0518	0.1153	0.6900
08	Cleaning restrooms regularly	0.7397	-0.4582	0.0274	0.1389	0.8353
09	Keeping the environment clean	0.7050	-0.6150	0.0812	0.0933	0.5347
10	Providing a comfortable seat	0.7034	-0.3847	0.0132	0.1542	0.9210
11	Providing on-time service	0.5425	-0.4654	0.0678	0.1116	0.6222
12	Providing fast and easy ways to correct errors	0.5434	-0.7152	0.1292	0.0348	0.2122
13	Increasing customer loyalty	0.6024	-0.7882	0.1452	0.0422	0.2250
14	keeping good accounting records	0.4609	-0.6332	0.1214	0.0523	0.3012
15	Providing good quality menu	0.5100	-0.7030	0.1306	0.0323	0.1981
16	Providing mutual support	0.5225	-0.5225	0.0829	0.0915	0.5247
17	Providing fast service assistance	0.6626	-0.6006	0.0794	0.0873	0.5236
18	Meeting Special Needs	0.7007	-0.4514	0.0286	0.1343	0.8246
19	Providing problem-solving skills	0.5530	-0.6380	0.1053	0.0577	0.3539
20	Keeping your client at ease	0.6006	-0.6336	0.0969	0.0667	0.4079
21	Offering menu information	0.6285	-0.4257	0.0389	0.1322	0.7727
22	Creating feeling of security	0.5750	-0.6660	0.1101	0.0535	0.3269
23	Creating an effective training program	0.6042	-0.5501	0.0722	0.0910	0.5577
24	Providing enough resource availability	0.5155	-0.3773	0.0690	0.1396	0.6694
25	Offering product customization	0.6820	-0.5630	0.0656	0.1006	0.6053
26	Achieving customer	0.6850	-0.5305	0.0549	0.1096	0.6663

	satisfaction					
27	Showing empathy in customer service	0.6806	-0.6456	0.0927	0.0813	0.4671
28	Maximizing customer wealth	0.7470	-0.6390	0.0883	0.0990	0.5285

Then, through aggregation by geometric mean, the relative closeness can be calculated as illustrated in Table 5. We can find that the 10th candidate is ranked first, and the 15th candidate is ranked list.

Table 5. The relative closeness and rank by TOPSIS.

No.	Separation measure of the group		Relative closeness	Rank
	$\overline{s_i^+}$	$\overline{s_i^-}$	$\overline{c_i^*}$	
10	0.0132	0.1542	0.9210	1
8	0.0274	0.1389	0.8353	2
18	0.0286	0.1343	0.8246	3
3	0.0333	0.1401	0.8081	4
6	0.0314	0.1319	0.8078	5
4	0.0333	0.1373	0.8047	6
21	0.0389	0.1322	0.7727	7
1	0.0424	0.1207	0.7401	8
7	0.0518	0.1153	0.6900	9
2	0.0532	0.1167	0.6867	10
24	0.0690	0.1396	0.6694	11
26	0.0549	0.1096	0.6663	12
11	0.0678	0.1116	0.6222	13
25	0.0656	0.1006	0.6053	14
23	0.0722	0.0910	0.5577	15
9	0.0812	0.0933	0.5347	16
28	0.0883	0.0990	0.5285	17
16	0.0829	0.0915	0.5247	18
17	0.0794	0.0873	0.5236	19
5	0.0781	0.0847	0.5201	20
27	0.0927	0.0813	0.4671	21
20	0.0969	0.0667	0.4079	22
19	0.1053	0.0577	0.3539	23
22	0.1101	0.0535	0.3269	24
14	0.1214	0.0523	0.3012	25
13	0.1452	0.0422	0.2250	26
12	0.1292	0.0348	0.2122	27
15	0.1306	0.0323	0.1981	28

5. Conclusions and remarks

In this paper, we present the results of comparison between TRIZ and Kano model for decision making. The five major DINESERV dimension for implementation were: Tangibles, Reliability, Responsiveness, Assurance, and Empathy.

The results of this study have several managerial implications regarding the improvement and development of service quality for mobile catering car's service quality on customer's expectations. Some effective strategies to improve and control the five top-priority improvement items were proposed. Tangibles-what are the benefits of upgrading your hardware and software; Reliability, Responsiveness, Assurance, Empathy includes: mobile cater car for people with special needs; Providing high-quality information from customer will keep customers coming back; How a mobile catering car can provide many of these resources to assist employee; Providing; Improving the employee training system; Satisfying customer requirements; Providing on-time or flexibility of service system to respond more.

Some effective strategies to improve and control the three top-priority improvement items. With new information technology (3GPP) overcome the shortage of information technology workers; for example, at least three strategies might be considered:

● Integrated GPS navigation system.

Catering services, local restaurants and franchise owners can rest assured knowing their food delivery trucks will arrive on time to their locations with the ATTI GPS fleet tracking system. With GPS technology, customer can track your catering car in real time, giving you access to the location and activity of each delivery vehicle from your computer or mobile device.

● Created a platform application of SNS (Social Networking Services).

A social networking service (SNS) is an online vehicle for creating relationships with other people who share an interest, background, or real relationship. The SNS system is based on online advertising, either through targeted advertising that utilizes an individual's personal information, search habits, location or other such data, or by selling the personal information to third parties.

● Created a Service Blueprint of mobile catering car.

Service blueprints are a critical part of the service design experience. Service blueprint design system that could be applied to catering car and other relevant events. Catering service appears to be a rising field, one form of special catering business model having attracted particular attention. A service blueprint may decrease probability of failure, help the achievement of controlled implementation and help catering car gain control of the design and management process.

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